

Redescription of *Dollfusentis heteracanthus* (Acanthocephala: Illiosentidae) from Bonefish, *Albula vulpes*, in the West Indies

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ABSTRACT: The original description of *Dollfusentis heteracanthus* (Cable and Linderoth, 1963) Golvan, 1969, was based on 6 immature adults and provided few measurements, which were incompatible with those of fully grown adults. The species is redescribed based on 27 fully developed mature adults collected from bonefish, *Albula vulpes* Linnaeus (Albulidae), in the West Indies. New information on sexual dimorphism, variability, and anatomical structures not included in the original description is added. The rarely observed copulatory interface is also described.

KEY WORDS: *Dollfusentis heteracanthus*, Acanthocephala, redescription, West Indies, *Albula vulpes*.

Dollfusentis heteracanthus (Cable and Linderoth, 1963) Golvan, 1969 (= *Illiosentis heteracanthus* Cable and Linderoth, 1963), was originally described from 6 immature adults (5 males, 1 female) from 4 marine fish species examined in Curacao, West Indies. Although the diagnostic features of the species are clearly definitive, reported measurements are inadequate and reflect only the very small size of the few immature structures measured. The only sex-linked measurements reported (in mm) are those of female trunk (3.68×0.45), distance between uterine bell and posterior end of trunk (0.5), male trunk $3.0\text{--}4.43 \times 0.34\text{--}0.50$, anterior testis (0.20–0.38 long), and posterior testis (0.18–0.30 long) (Cable and Linderoth, 1963). The few other measurements provided apply to both sexes: proboscis $0.86\text{--}1.5 \times 0.07\text{--}0.15$, crescent hooks 0.074–0.102 long, anterior hooks 0.032–0.051 long, middle hooks 0.032–0.041 long, posterior closely spaced hooks 0.010–0.020 long, trunk spines 0.020 long anteriorly and 0.030 posteriorly, proboscis receptacle 0.825–1.35 long.

Materials and Methods

Twenty-seven sexually mature adult *D. heteracanthus* (males with sperm and gravid females) were collected from the intestines of 6 of 12 bonefish, *Albula vulpes* Linnaeus, netted in Bell Sound, 11.2 km north of South Caicos, Turks, and Caicos islands, British West Indies, in September 1992. Worms were fixed in alcohol-formalin-acetic acid, stained in Mayer's acid carmine, dehydrated in ascending concentrations of ethanol, cleared in graduated concentrations of terpineol in 100% ethanol, and whole mounted in Canada balsam. Measurements are of the longest and widest

dimensions of measured structures. Trunk measurements do not include neck or male bursa. Hooks were measured only in perfect profile and counted from at least 2 adjacent rows. All measurements are in micrometers unless otherwise specified (means are in parentheses). Figures are made to illustrate structures not included in or at variance with those presented by Cable and Linderoth (1963).

Results

Some of our worms reached as long as 6 times those described by Cable and Linderoth (1963), and all other measured structures are correspondingly larger. Despite these size discrepancies, our worms were identified as *D. heteracanthus* based on having 26–29 proboscis hooks per row that are dorsoventrally dimorphic, dorso-lateral interruption of trunk spines, close proximity of the ventral crescent to other hooks, lateral proboscis papillae between ninth and eleventh hooks from posterior end of row, 6–8 reduced proboscis hooks at posterior end of each row, and shape of female posterior extremity.

The species is herein redescribed (based only on our material) to provide (1) a complete account of the typical size and usual variations in anatomical structures of fully developed, sexually mature adults, (2) a description of mature structures and measurements of other structures not previously reported or measured, e.g., reproductive system and lemnisci, (3) a description of variations, e.g., in trunk spines, not previously possible because of sample size, and (4) corrected and refined measurements of Cable and Linderoth (1963) material that are related to the im-

maturity of the type specimens, e.g., size of trunk spines; differential rate of growth may be involved.

Examination of the type material confirmed their immature state and the justification for redescription. One criterion of immaturity (in addition to the incomplete development of the reproductive system and size) is the relatively larger size of proboscis compared with trunk. In mature adults, the trunk continues to grow after the proboscis and its hooks have reached their full size (see Amin and Redlin, 1980; Amin, 1987). In Cable and Linderöth's (1963) specimens, the proboscis length: trunk length was ca. 1:3.0. In our specimens, this ratio was 1:5.5 in males and 1:8.0 in females. The small and unrepresentative size of the type specimens, the incompletely developed male reproductive system, the inapparent proboscis receptacle swelling and brain, and the limited variation in distribution and pattern of trunk spines were clearly visible.

The following redescription is based on 20 fully developed mature adults (10 males with sperm and 10 gravid females).

Redescription

Dollfusentis heteracanthus

(Cable and Linderöth, 1963) Golvan, 1969
(Figs. 1-4)

GENERAL: With characters of the genus *Dollfusentis*. Shared structures larger in females than in males. Trunk cylindrical and elongate, widest just anterior to middle, with stout hypodermal spines that extend from narrow anterior end of trunk to level of half the length of proboscis receptacle to shortly past its posterior end ventrally and a shorter distance dorsally; anterior spines relatively longer than posterior. Field of trunk spines with a bare ovoid dorsolateral zone that is variably pronounced. Proboscis long, cylindrical, with 14 longitudinal rows of 26-29 rooted hooks each; posterior 6-8 (usually 7-8) hooks of each row much reduced in size, strongly recurved, closely spaced with posteriormost largest. Ventrolateral crescent of 6 large hooks just posterior to posteriormost hooks. Other proboscis hooks outside the crescent normal, anteriormost about as long as longest ventral hooks at middle of proboscis but less robust; middorsal hooks opposite midventral hooks markedly thinner and relatively shorter; a pair of lateral papillae present between ninth and eleventh hooks from posterior end of hook rows. Neck contin-

uous with proboscis and invariably bent ventrad. Proboscis receptacle slightly longer than proboscis and widest near its anterior end where the brain is located in a nearly rectangular enlargement. Lemnisci usually equal, about 3 times as long as proboscis receptacle, extending to posterior testis in males and to a corresponding distance in females, may be folded once or twice.

MALES: Trunk 5.200-11.800 (7.535) mm long by 0.760-1.200 (0.844) mm wide with trunk spines somewhat longer anteriorly, 25-45 (37), than posteriorly, 25-35 (32). Proboscis 1.120-1.820 (1.365) mm long by 112-210 (149) wide; anterior hooks 41-57 (50) long; midventral hooks 48-67 (56) long by 13-16 (15) wide at base; mid-dorsal hooks 35-45 (40) long by 3-9 (7) wide at base; largest posteriormost reduced hooks 23-35 (27); crescent hooks 80-118 (95) long. Proboscis receptacle 1.260-1.890 (1.621) mm long by 126-238 (176) wide at anterior enlargement (Fig. 1). Lemnisci 3.640-6.020 (4.459) mm long by 140-252 (180) wide. Male reproductive system (Fig. 2) robust and occupies posterior part of body cavity; testes contiguous, in tandem. Anterior testis 0.532-1.400 (0.832) mm long by 266-616 (367) wide. Shorter and wider posterior testis 0.420-1.260 (0.655) mm long by 280-560 (377) wide; 8 club-shaped tightly packed cement glands just behind posterior testis with anterior bulb 98-168 (145) in diameter; common sperm duct enlarged into a well-developed thick-walled bulboid seminal vesicle 252-658 (401) long by 168-518 (289) wide that opens into anterior end of cirrus; large Saeftigen's pouch 0.588-1.470 (0.920) mm long by 266-560 (360) wide; pyriform highly muscular cirrus 420-700 (512) long by 210-476 (291) wide; large well-developed bursa 0.602-1.204 (0.839) mm long by 0.448-1.050 (0.657) mm wide.

FEMALES: Trunk 7.000-19.520 (11.772) mm long by 0.800-1.600 (1.040) mm wide with trunk spines somewhat longer anteriorly, 25-64 (38), than posteriorly, 19-42 (30). Proboscis 1.050-1.820 (1.470) mm long by 112-280 (170) wide; anterior hooks 48-64 (53) long; midventral hooks 48-64 (54) long by 16-19 (16) wide at base; mid-dorsal hooks 45-48 (47) long by 7-9 (8) wide at base; largest posteriormost reduced hooks 29-45 (35) long; crescent hooks 96-112 (101) long. Proboscis receptacle 1.400-1.960 (1.590) mm long by 126-196 (156) wide at anterior enlargement. Lemnisci 3.500-5.180 (4.638) mm long by 112-168 (144) wide. Dorsoposterior end receded anteriorly above terminal gonopore (see Cable and

Linderoth, 1963); eggs (Fig. 3) elongate with polar prolongation of middle membrane, 48–64 (56) long by 9–16 (14) in diameter.

DEFINITIVE HOSTS: Yellowfin mojarra, *Gerres cinereus* (Walbaum) (Gerreidae); frillfin goby, *Bathygobius soporator* (Valenciennes) (Gobiidae); hairy blenny, *Labrisomus nuchipinnis* (Quoy and Gaimard) (Clinidae); flounder, *Platophrys ocellatus* (Agassiz) (Bothidae); bonefish, *Albula vulpes* Linnaeus (Albulidae).

SITE OF INFECTION: Intestine.

LOCALITY: West Indies at Curacao, South Caicos, Turks, and Caicos islands.

DEPOSITED SPECIMENS: U.S. National Parasite Collection No. 85059 (voucher males and females including those in figures).

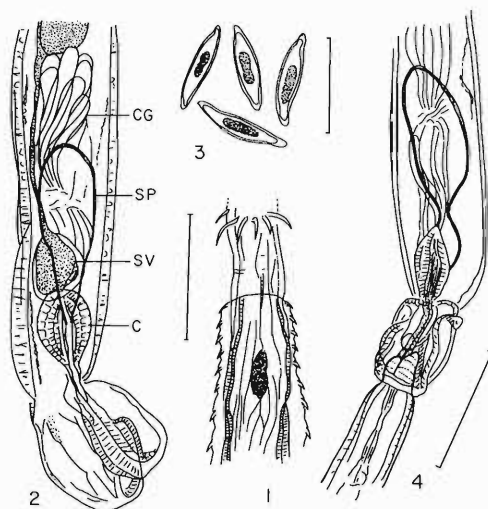
EXAMINED SPECIMENS: U.S. National Parasite Collection No. 60343 (holotype and paratypes).

REMARKS: This is the first description of mature adult *D. heteracanthus*. The specimens are from a new host, *Albula vulpes*, in the West Indies from where the type material was originally described. The distribution of this acanthocephalan, and perhaps other species of the genus, however, may not be limited to the West Indies and could well extend into the shallow marine waters of the southeastern United States (Amin, 1996).

Considering the state of maturity and development of our worms, bonefish are regarded as natural definitive hosts. Whether the other fish hosts of Cable and Linderoth's (1963) material may be accidental hosts where worms do not reach sexual maturity is unknown. The immature female and 2 males obtained from the flounder, *P. ocellatus*, were juveniles still enclosed within their cystic membranes (Cable and Linderoth, 1963).

Unlike the original description, our specimens show that anterior trunk spines of *D. heteracanthus* are somewhat larger than posterior ones. This feature, thus, becomes consistent in all species of *Dollfusentis*.

The limited number of specimens available to Cable and Linderoth (1963) did not allow the exploration of variability in the distribution of trunk spines. These spines extended ventrally to the level of half the length of proboscis receptacle (LPR) (in 6 males and 2 females), to 50–90% LPR (in 2 males and 4 females), to 100% LPR (in 1 male and 1 female; as in original description), and past the level of the posterior end of proboscis receptacle (in 1 male and 3 females). The bare dorsal area within the field of trunk



Figures 1–4. *Dollfusentis heteracanthus* from *Albula vulpes*. 1. Ventral view of anterior end of a male proboscis receptacle showing broad area housing the brain, the neck, and the posterior end of the proboscis with crescent hooks. 2. Ventral view of same male showing details of reproductive system. CG, cement gland; C, cirrus; SP, Saeftigen's pouch; SV, seminal vesicle. 3. Ripe eggs from the body cavity of a female. 4. Lateral view of posterior regions of a copulating male (above) with bursa enclosing the posterior end of the female. Scale bars = 1 mm (Figs. 1, 2, 4) and 50 μ m (Fig. 3).

spines was usually evident, but its extent varied considerably.

The number of reduced recurved hooks at the posterior end of proboscis hook rows varied between 6 and 8 (usually 7 or 8) but was more often 7 in males and more evenly distributed in females. The lateral sensory papillae were more often between proboscis hooks 10 and 11 than between 9 and 10 in females, from posterior end of hook rows, but more evenly distributed in males.

The position of the brain is the first to be precisely described in any species of the genus; it is anterior in the *D. heteracanthus* proboscis receptacle.

The lemnisci apparently continue to grow during later developmental stages, becoming about 3 times as long as the proboscis receptacle in our specimens; they were twice as long in immature adults (Cable and Linderoth, 1963).

Four of our worms had body wall anomalies (tegumental swelling) similar to those attributed to glycogen–phospholipid metabolic dysfunction and described in other acanthocephalan species by Amin (1984, 1989).

A male and a female collected and fixed in

copulatory position (Fig. 4) provided an opportunity to document copulatory interface as well as some fully developed adult reproductive structures not included in the original description. The copulating female was gravid with unripe eggs and some ovarian balls, suggesting that this might not have been its first copulation. Note the enclosing of female posterior end within the male bursa, contraction of the edge of the bursal musculature resulting in the constriction of the posterior end of the female trunk, and suction of her gonopore region into the male body. This observation clearly disputes Yamaguti's (1963) belief that evagination of the bursa is a post-mortem phenomenon.

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